Oxidizer Decontamination of Building Materials Contaminated with Methamphetamine

By

John W. Martyny, Ph.D., CIH
Associate Professor
National Jewish Medical and Research Center
Division of Environmental and Occupational Health Sciences

Introduction:

Concerns regarding chemical contamination associated with the clandestine production of methamphetamine have been realized for some time. [1 – 10] Work conducted by National Jewish Medical Center Researchers has documented a number of the contaminants generated at clandestine laboratories and the presence of some of these contaminants in actual methamphetamine laboratory investigations.[11]

Research conducted by our group has indicated that the contamination associated with these clandestine methamphetamine laboratories does not end when the laboratory ceases operation.[11] Simulated methamphetamine cooks conducted by our group have demonstrated that a number of compounds may persist after the cook has been completed. Initial testing revealed that shortly after a clandestine cook, levels of iodine, hydrogen chloride, and methamphetamine were found at the site even though the bulk chemicals may have been removed. The largest contaminant was found to be the drug, methamphetamine, itself. Methamphetamine was found to aerosolize during the salting-out phase conducted during all current production methodologies. It is released as an aerosol and can contaminate most surfaces within a structure.[11] Our research also indicated that the methamphetamine continues to be present within the structure for some period of time (months to years).

The levels of methamphetamine found within a structure after clandestine cooks is a factor of the type of cook and the number of cooks conducted. Red phosphorous cooks appear to result in a higher concentration of methamphetamine release than do anhydrous ammonia cooks and multiple cooks will result in a higher contamination level.[11] Surface wipes for methamphetamine were collected at suspected methamphetamine laboratories during law enforcement actions. A total of 14 suspected laboratories were sampled with all of the laboratories having at least one sample positive for methamphetamine. The levels of methamphetamine found ranged from a low of 1.0 μg/sample to a high of 16,000 μg/sample. The overall mean methamphetamine contamination level in these suspected laboratories was 511 μg/sample with a median contamination level of 28 μg/sample.

Further research has indicated that simply by using methamphetamine, the drug will be deposited on surfaces within the structure. We conducted a simulated "smoke" using methamphetamine and found that a significant amount of methamphetamine is released during that process. Depending upon how much methamphetamine is used within a structure the mean level of methamphetamine on the walls may range from less than 0.1 ug/100 cm^2 to as high as 5 ug/100 cm^2. These lower levels of contamination are being more commonly encountered as residences are increasingly monitored for methamphetamine during realty transactions. As low as these levels appear to be, they are normally above the levels that have been promulgated by the states for cleanup.

A previous study using Simple Green as a decontamination agent indicated that the removal rate of methamphetamine from a semi-porous surface ranged from approximately 60% to 80% on the first wash. Subsequent washes resulted in much less

removal with a total removal rate of approximately 80% for three washes. In many decontamination scenarios, an 80% removal rate will not reduce methamphetamine contamination levels to less than the current state standards. Discussions with a number of state regulators indicated that many decontamination firms were using an oxidizer of some type to further reduce methamphetamine contamination on painted surfaces. For this reason, we decided to test the decontamination capability of two cleaning compounds that contained oxidizers. The tests were conducted on drywall surfaces that had been painted with a latex paint.

Methodology:

This study was conducted to determine the impact of washing painted drywall surfaces with a cleaner containing an oxidizing compound. The drywall utilized in this project was 3/8th inch gypsum board that was cut into 24" x 24" squares. The drywall was painted with a latex enamel paint by painting the surface with two coats of paint, letting the paint dry and then painting it again with the same latex paint. Good coverage was provided and a gallon of paint was found to cover a total of 16 panels. After the painting, the paint was allowed to dry for a period of at least 2 days prior to contaminating the panels with methamphetamine.

Figure 1. Painting drywall with a base paint prior to contaminating the board in the chamber.

After painting, the drywall panels were put into the chamber for contamination. A total of 9 drywall panels were contaminated on September 21, 2008 using 206 mg of methamphetamine. The methamphetamine was aerosolized starting at 12:40 pm and the

aerosolization was complete at 12:55 pm. The fans in the chamber were run until 2:30 pm and the drywall was removed the next day at 11:00 am after a 3 hour evacuation of the chamber.

The methamphetamine utilized for contamination was a street-manufactured methamphetamine provided by the North Metro Task Force in Colorado. The drug was approximately 77% methamphetamine and also contained small amounts of amphetamine, ephedrine, and pseudophedrine. No MDMA or phenylpropanolamine were found to be present. The methamphetamine was put into a beaker and the chamber was sealed and the methamphetamine aerosolized in the chamber. The methamphetamine was completely aerosolized within a short time (listed above) and the beaker heater was turned off. The fans within the chamber were kept running for another period of time to assure even distribution of the methamphetamine. The chamber was then allowed to sit overnight and the material was removed the next day.

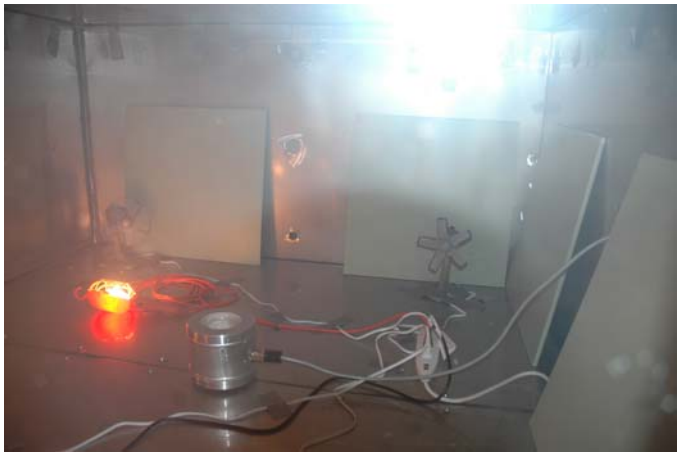

Figure 2. Painted drywall material being contaminated within the chamber.

After the material was removed from the chamber, it was placed in a plastic bag and transported to an area to be pre-sampled, washed, and post sampled.

Figure 3. Drywall being removed for transportation to an area to be sampled and treated.

After being transported, the panels were divided into 2 groups of three for testing. The groups were as follows:

a. Sodium Hypochlorite Cleaner
    i. One panel was not washed.
    ii. One panel was washed 1 time and then tested.
    iii. One panel was washed 3 times and then tested.
b. Quaternary Ammonia Cleaner
    i. One panel was not washed.
    ii. One panel was washed 1 time and then tested.
    iii. One panel was washed 3 times and then tested.

Five samples were collected prior to treatment and after treatment, resulting in a total of 10 samples being taken from each of the drywall panels. Each sample consisted of a 100 cm^2 area being sampled from the panel using a 3"x 3" cotton swab to which 3 ml of methanol were added. After sampling the wipe was then put into a plastic centrifuge tube and sent to the laboratory for analysis.

For each panel, there were a total of 36 potential 100 cm^2 samples available. The squares sampled were determined using random number generator for each panel using numbers from 1 – 36. The two groups of 5 samples were generated with no replicates and the position of the samples were located on the panel using the following template:

iv.	1	2	3	4	5	6
v.	7	8	9	10	11	12
vi.	13	14	15	16	17	18
vii.	19	20	21	22	23	24
viii.	25	26	27	28	29	30
ix.	31	32	33	34	35	36

Figure 4. Panel prepared for initial pre-sampling after contamination.

After the collection of the pre-samples, the panels were then washed for the prescribed number of treatments using the appropriate cleaner. The cleaner was used according to label directions for a maximum degreasing. The cleaner was applied full-strength from a spray bottle onto the surface of the panel. The cleaner was allowed to sit on the panel for approximately 1. 5 minutes and then it was washed off using clean water and a cloth. The surface was not scrubbed hard and no abrasive materials were utilized. After cleaning, the panels were allowed to dry completely before subsequent cleanings or prior to post sampling.

Figure 5. Pictures of the oxidizer cleaners utilized during this experiment.

The 409 cleaner contained 0.3% of alkyl dimethyl benzyl ammonium chloride and the Clorox Clean-Up contained 1.84% of sodium hypochlorite. Both products are manufactured by Clorox Corporation and are sold in retail outlets. The Material Safety Data Sheets for these products are attached to this report.

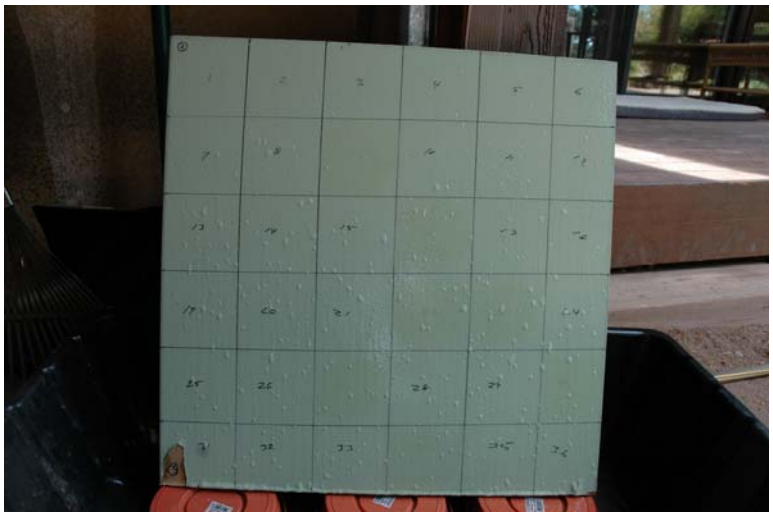

Figure 5. Washing the panel with the oxidizer solutions.

After the treatment, the panels were sampled in the same manner as in the pre-sample portion of the project and the samples sent to DataChem laboratories for analysis.

Results:

A total of 60 samples were collected from the drywall material. For each group of 5 samples, a mean, median and percent reduction was calculated. The results for the quaternary ammonium compound (Formula 409 Cleaner) were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	20.2	21	21	21	-4 %
One Wash	26	27	2.7	2.7	90%
Three Washes	18	18	1.0	1.0	95%

These results indicate that the washing process using a quaternary ammonia compound was able to initially remove a total of 90% of the methamphetamine contamination in just one wash. The second wash only removed an additional 5% from the drywall surface. The initial removal was higher than the removal observed using Simple Green but it was still not enough to reduce the contamination levels to below most state standards. At the end of three washes, the levels were slightly lower but still were still above most current state standards. It appears that the initial wash removed the methamphetamine contamination that was the easiest to remove and subsequent washes were not able to remove much more methamphetamine.

The results obtained from the drywall contamination using the hypochlorite solution (Clorox Clean-Up) were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	20.2	20	21.4	22	-5.9 %
One Wash	20.4	20	8.9	9.3	57%
Three Washes	23.6	23	8.4	8.3	64%

The decontamination using the sodium hypochlorite solution did not result in as large a reduction in the methamphetamine contamination as did the quaternary ammonium-containing cleaner. The total amount of contamination removed was 64% after the three separate washes. The initial decontamination level was 57% as compared to 90% for the

quaternary ammonium compound. The total reduction was only 64% as compared to the 95% reduction after using the quaternary ammonium compound. Again the 3 washes did not remove all of the methamphetamine but after the initial wash, the remaining methamphetamine was not easily removed.

Discussion and Conclusions:

The results of the decontamination using the oxidizer cleaners were variable depending upon the cleaner that was utilized. The quaternary ammonia cleaner appeared to result in a much higher reduction in methamphetamine than did the sodium hypochlorite compound. This was true of both the first wash and of the second wash. The quaternary ammonia product appears the be the best compound tested to date for the removal of methamphetamine from painted drywall surfaces.

Although these drywall surfaces were not able to be completely cleaned by the use of a cleaner, the inability of the detergent to remove methamphetamine after the initial amount was removed may suggest that the remaining methamphetamine is not completely available for removal. It is possible that after the initial methamphetamine is removed, that the remaining methamphetamine may not easily leave the surface of the porous materials simply due to touch or simple cleaning. Exposures therefore, may be significantly reduced after the initial cleaning.

There are a number of limitations to this study that must be considered. We utilized only latex paint similar to that used in most houses but not all houses. It is possible that a more impervious paint exists that would not absorb the methamphetamine and make decontamination easier. We also only let the paint cure for a couple of days prior to exposing it in the chamber. Paint that has cured longer may be less permeable to the methamphetamine although Minnesota did not find that to be the case.

In some cases, methamphetamine removal may be even more difficult that we found since we did not apply texturing or any other surface to the wood or drywall prior to painting. Texture could make decontamination even more difficult since the methamphetamine may penetrate even deeper into the surface of the material.

Although the use of these oxidizing compounds, especially the quaternary ammonia compounds, resulted in a significant reduction in the amount of methamphetamine present, there are concerns regarding the use of these compounds. Individuals using these compounds must realize that the compounds can be very toxic when used in a confined space. Pulmonary problems have been reported when these products are used in a confined space. In addition, it is not known what by-products, if any, are left behind after the use of these compounds. Chlorine can combine with organic materials to form compounds that can result in further contamination of the residence. Until the by-products for this type of treatment can be determined, widespread use of these materials should be limited.

References:

1. Cameron, M.: Health and safety concerns for law enforcement personnel investigating clandestine drug labs. J. Chemical Health and Safety, January/February 2002: pp. 6 – 9.

2. U.S. DOJ. Methamphetamine Production Methods: A Guide for First Responders. United Sates Department of Justice. Product # 2003-L0490-001. March 2003. 11pp.

3. National Drug Intelligence Center. Information Bulletin. Children at Risk. Product # 2002-LO424-001. U.S. Department of Justice. Johnstown, PA. July 2002. 7 pp.

4. Skeers VM. Illegal methamphetamine drug labs: a new challenge for environmental health professionals. *J Environ Health* 1992; 55(3):6-10.

5. Vandeveld N. Clandestine methamphetamine labs in Wisconsin. *J Environ Health* 2004;66(7):46-50.

6. Centers for Disease Control. 2000. MMWR. Public Health Consequences Among First Responders to Emergency Events Associated With Illicit Methamphetamine Laboratories – Selected States, 1996 – 1999. MMWR Weekly, November 17, 2000 / 49(45):1021 –1024.

7. Washington State Department of Health. Methamphetamine Related Incidents Included in the Hazardous Substances Emergency Event Surveillance Database in Washington State, 2001. Washington Department of Health, Office of Environmental Health and Safety, Olympia, WA , July 2002. 8 pp.

8. Burgess, J. L., Kovalchick, D.F., Siegel, E.M., Hysong, T.A., McCurdy, S.A. 2002. Medical Surveillance of Clandestine Drug Laboratory Investigators. JOEM 44(2) 184 – 189.

9. Burgess, J.L., Barnhart, s., Checkoway, H. 1996. Investigating Clandestine Drug Laboratories: Adverse Medical Effects in Law Enforcement Personnel. Amer. J. of Indust. Medicine 30:488 – 494.

10. Witter, R.Z., Martyny, J.W., Mueller, K., Gottschall, B., Newman, L.S. Symptoms experienced by law enforcement personnel during methamphetamine lab investigations. J. Occupational and Environmental Hygiene 4: 895 – 902. (2007)

11. Martyny, J.W., Arbuckle, S.L., McCammon, C.S., Esswein, E.J., Erb, N., Van Dyke, M.: Chemical concentrations and contamination associated with

clandestine methamphetamine laboratories. J. of Chemical Health and Safety 14(4):40 – 52 (2007)

Results of Drywall Decontamination with Oxidizing Compounds.

Building Material Decontamination with Oxidizer Results

Sample #	Material Type	Treatment	Meth Conc.	Mean	Median	% reduction Mean
OCN-1	Drywall	Oxidizer Cleaner Blank	17			
OCN-2	Drywall	Oxidizer Cleaner Blank	22			
OCN-3	Drywall	Oxidizer Cleaner Blank	20			
OCN-4	Drywall	Oxidizer Cleaner Blank	21			
OCN-5	Drywall	Oxidizer Cleaner Blank	21	20.2	21	
OCN-6	Drywall	Oxidizer Cleaner Blank	25			
OCN-7	Drywall	Oxidizer Cleaner Blank	17			
OCN-8	Drywall	Oxidizer Cleaner Blank	22			
OCN-9	Drywall	Oxidizer Cleaner Blank	21			
OCN-10	Drywall	Oxidizer Cleaner Blank	20	21	21	-4.0
OC1-1	Drywall	Oxidizer - 1 wash	27			
OC1-2	Drywall	Oxidizer - 1 wash	25			
OC1-3	Drywall	Oxidizer - 1 wash	24			
OC1-4	Drywall	Oxidizer - 1 wash	27			
OC1-5	Drywall	Oxidizer - 1 wash	27	26	27	
OC1-6	Drywall	Oxidizer - 1 wash	3.3			
OC1-7	Drywall	Oxidizer - 1 wash	2.8			
OC1-8	Drywall	Oxidizer - 1 wash	2.2			
OC1-9	Drywall	Oxidizer - 1 wash	2.3			
OC1-10	Drywall	Oxidizer - 1 wash	2.7	2.66	2.7	89.8
OC3-1	Drywall	Oxidizer - 3 washes	19			
OC3-2	Drywall	Oxidizer - 3 washes	16			
OC3-3	Drywall	Oxidizer - 3 washes	18			
OC3-4	Drywall	Oxidizer - 3 washes	15			
OC3-5	Drywall	Oxidizer - 3 washes	22	18	18	
OC3-6	Drywall	Oxidizer - 3 washes	0.96			
OC3-7	Drywall	Oxidizer - 3 washes	1.1			

OC3-8	Drywall	Oxidizer - 3 washes	0.85			
OC3-9	Drywall	Oxidizer - 3 washes	0.99			
OC3-10	Drywall	Oxidizer - 3 washes	0.89	0.958	0.96	94.7
CCN-1	Drywall	Hypochlorite - blank	19			
CCN-2	Drywall	Hypochlorite - blank	22			
CCN-3	Drywall	Hypochlorite - blank	20			
CCN-4	Drywall	Hypochlorite - blank	19			
CCN-5	Drywall	Hypochlorite - blank	21	20.2	20	
CCN-6	Drywall	Hypochlorite - blank	20			
CCN-7	Drywall	Hypochlorite - blank	22			
CCN-8	Drywall	Hypochlorite - blank	23			
CCN-9	Drywall	Hypochlorite - blank	22			
CCN-10	Drywall	Hypochlorite - blank	20	21.4	22	-5.9
CC1-1	Drywall	Hypochlorite - 1 wash	23			
CC1-2	Drywall	Hypochlorite - 1 wash	19			
CC1-3	Drywall	Hypochlorite - 1 wash	18			
CC1-4	Drywall	Hypochlorite - 1 wash	22			
CC1-5	Drywall	Hypochlorite - 1 wash	20	20.4	20	
CC1-6	Drywall	Hypochlorite - 1 wash	9.3			
CC1-7	Drywall	Hypochlorite - 1 wash	9.4			
CC1-8	Drywall	Hypochlorite - 1 wash	8.1			
CC1-9	Drywall	Hypochlorite - 1 wash	7.7			
CC1-10	Drywall	Hypochlorite - 1 wash	9.9	8.88	9.3	56.5
CC3-1	Drywall	Hypochlorite - 3 wash	25			
CC3-2	Drywall	Hypochlorite - 3 wash	26			
CC3-3	Drywall	Hypochlorite - 3 wash	23			
CC3-4	Drywall	Hypochlorite - 3 wash	22			
CC3-5	Drywall	Hypochlorite - 3 wash	22	23.6	23	
CC3-6	Drywall	Hypochlorite - 3 wash	7.6			
CC3-7	Drywall	Hypochlorite - 3 wash	8.3			
CC3-8	Drywall	Hypochlorite - 3 wash	8.6			
CC3-9	Drywall	Hypochlorite - 3 wash	9.6			
CC3-10	Drywall	Hypochlorite - 3 wash	8	8.42	8.3	64.3